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ABSTRACT

The world is faced with a variety of environmental problems. No country has escaped pollution and resource depletion. Basic ecological principles are often ignored and sometimes this contributes to ecological disasters. This volume is designed to provide basic information about the quality of the earth's water resources. The visual aids, worksheets, and activity pages are designed to promote investigative and inquiry experiences, and to foster the use of critical thinking skills through the analysis of environmental problems and solutions. An additional feature is the inclusion of a take-home activity. The activity may be done with simple materials or by conducting a survey. The teaching guide provides suggestions for discussion questions to initiate class participation. Extension activities are also suggested. A research activity that can be used to challenge students and an interdisciplinary activity are also provided. This guide contains 12 reproducible hand-outs, a teaching guide, and four overhead transparencies. Topics include the water on Earth, groundwater, acid rain, oil spills, ocean and coastal pollution, drinking water, health issues, keeping water clean, the water cycle, water treatment, and waste water. A review quiz is also included. (CW)

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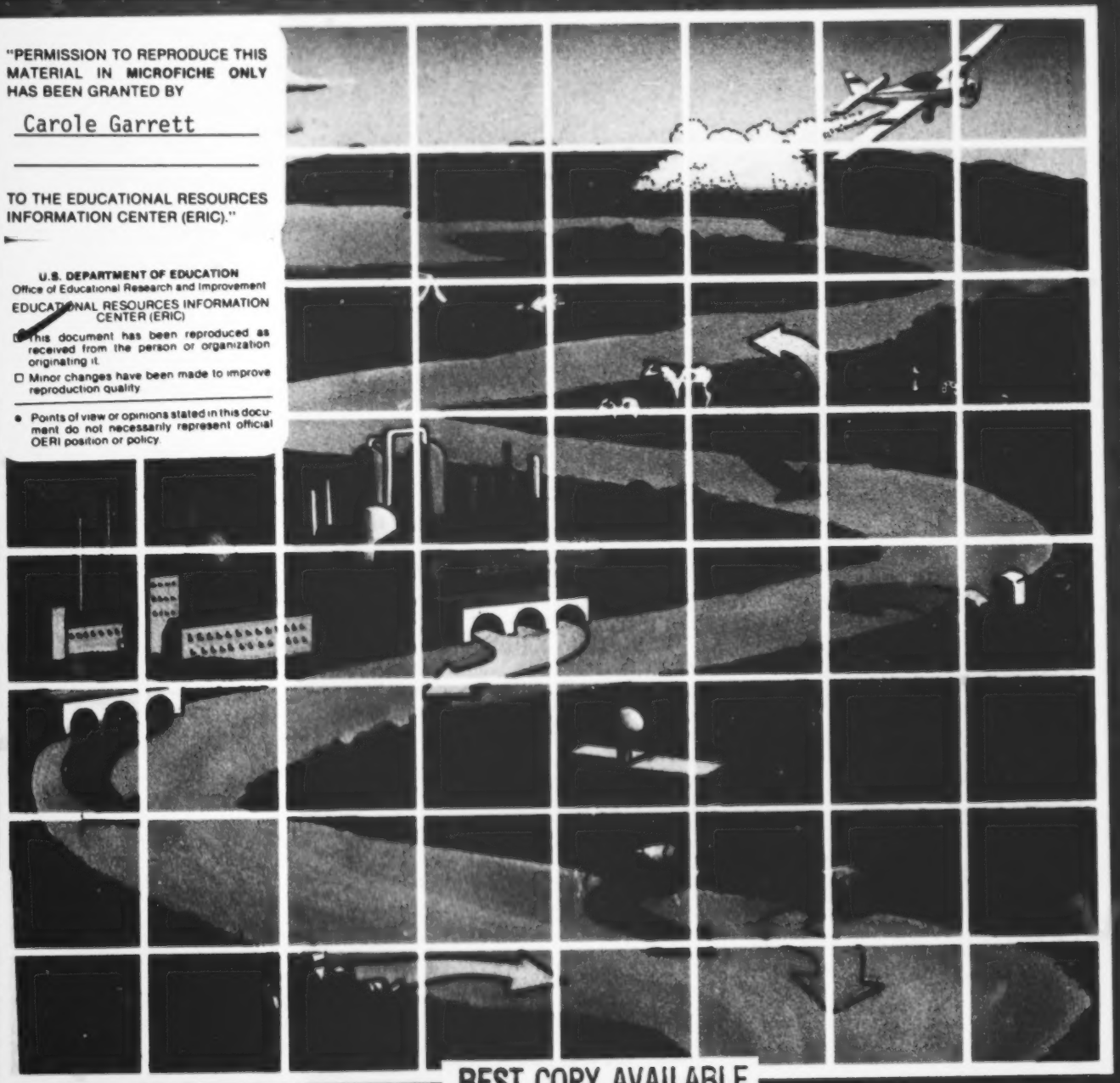

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Environmental Studies

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WATER QUALITY AND POLLUTION

The world today is faced with a variety of environmental problems. No country in the world has escaped pollution and resource depletion. Basic ecological principles are often ignored and bring about environmental disasters.

This environmental series is designed to assist teachers in developing among their students an awareness of ecological principles and basic concepts of environmental science. The visual aids, worksheets, and activity pages foster investigative and inquiry experiences. The use of critical thinking skills is encouraged as students are guided to analyze problems and suggest solutions.

An additional feature is the inclusion of a take-home activity. The activity is designed to be done with simple materials or by conducting a survey. This will provide an opportunity for parent involvement in the environmental studies.

The teaching guide provides suggestions for discussion questions to initiate class participation in the study of environmental issues. Extension activities are also provided. The research activity can be used to challenge students and the interdisciplinary activity integrates environmental science with other subjects.

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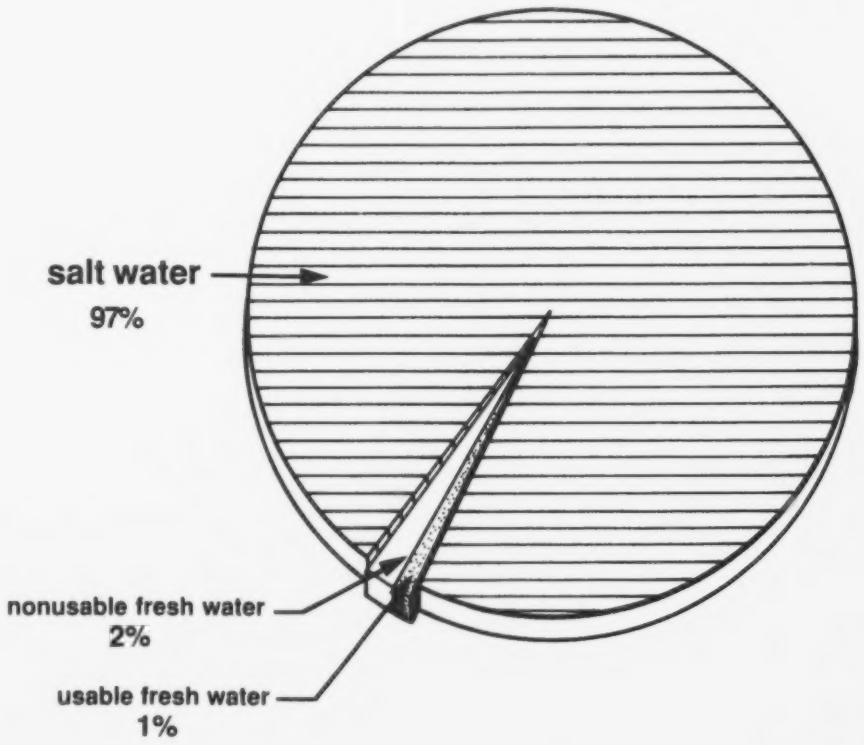
Water on the Earth



1. Is the earth's surface mostly land or water?

2. Is the earth's water mostly salt water or fresh water?

3. What percent (%) of the water on earth can we use for drinking? Color that part of the graph blue.

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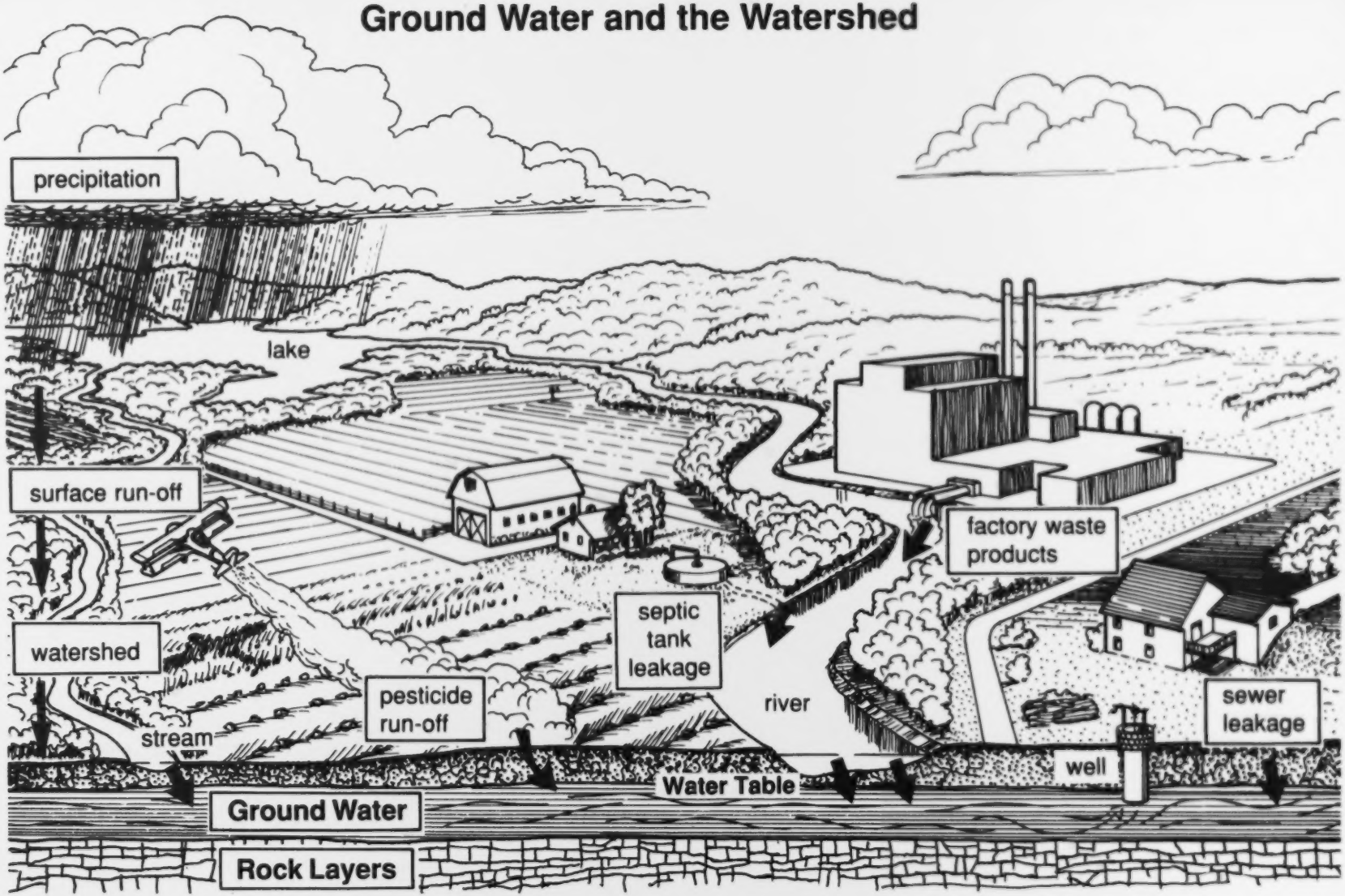
Ground Water and the Watershed



5

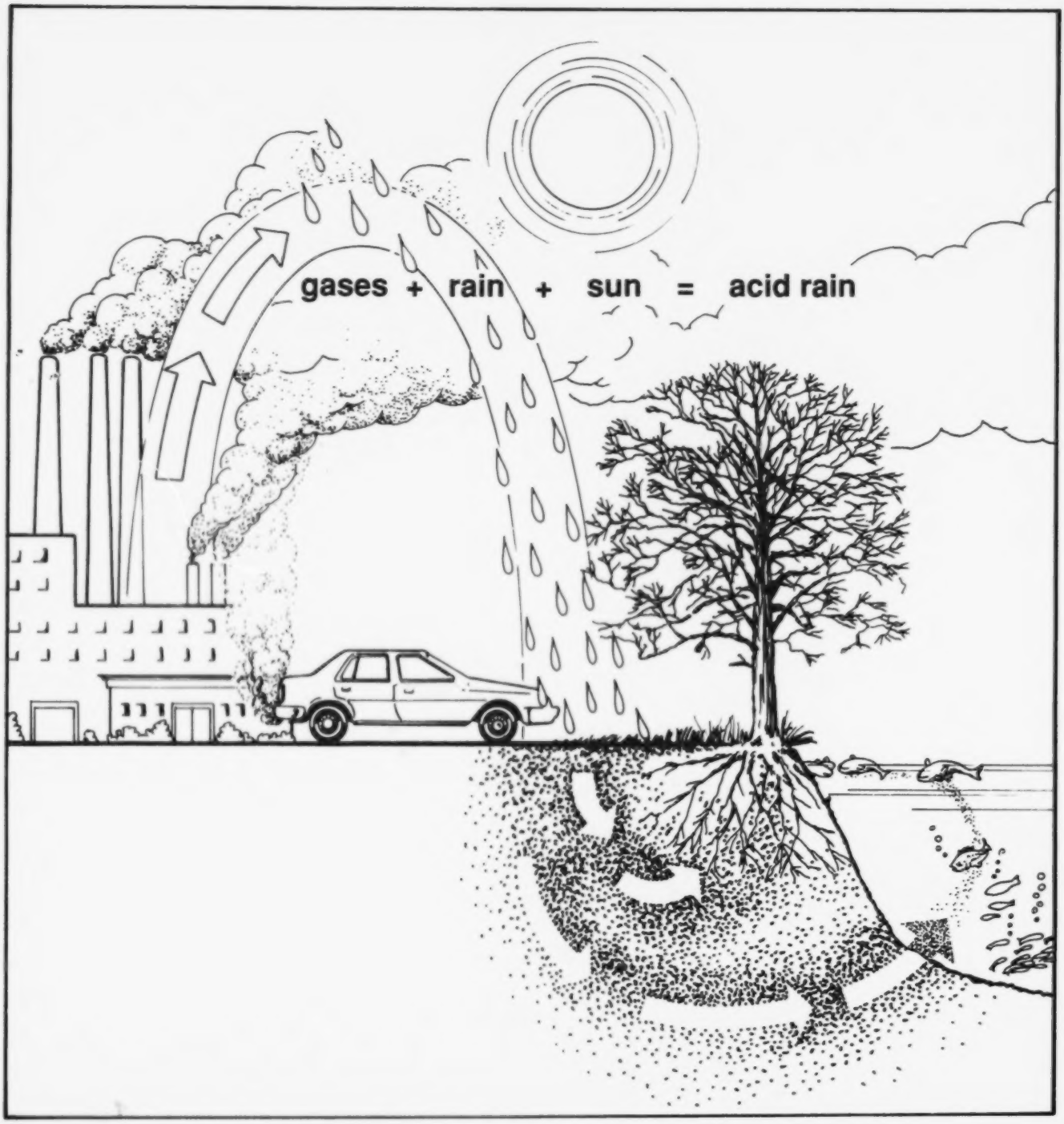
Q

1. What is the source of ground water?

2. What sources of ground water pollution does this page show?

6

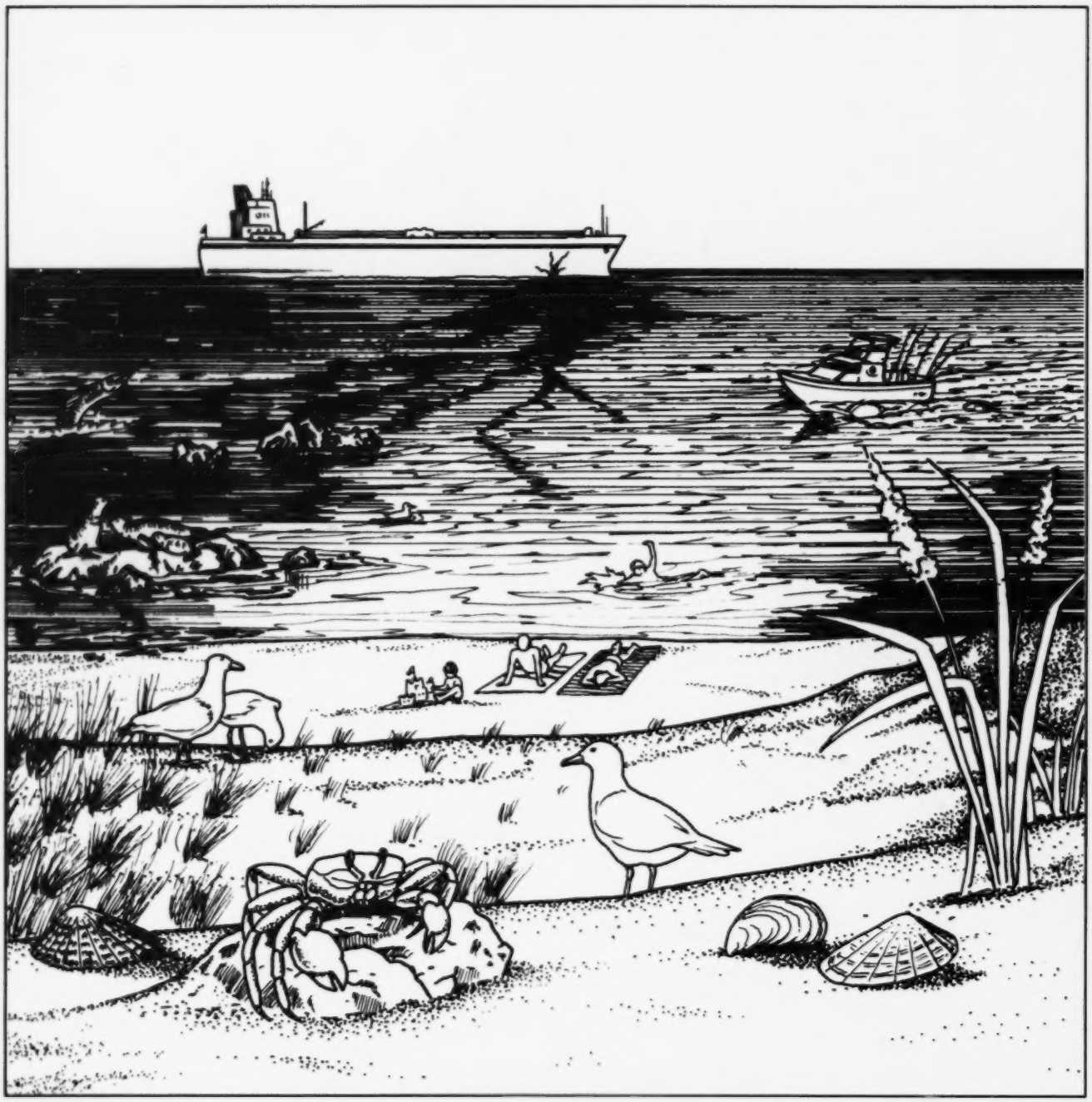
Acid Rain



1. What effect does acid rain have on the environment?

2. What must be done to help stop acid rain?

Oil Spills



Study the picture. Describe what might happen.

Q

1. What are four effects the oil spill will have on the environment?

2. What can be done to prevent oil spills?

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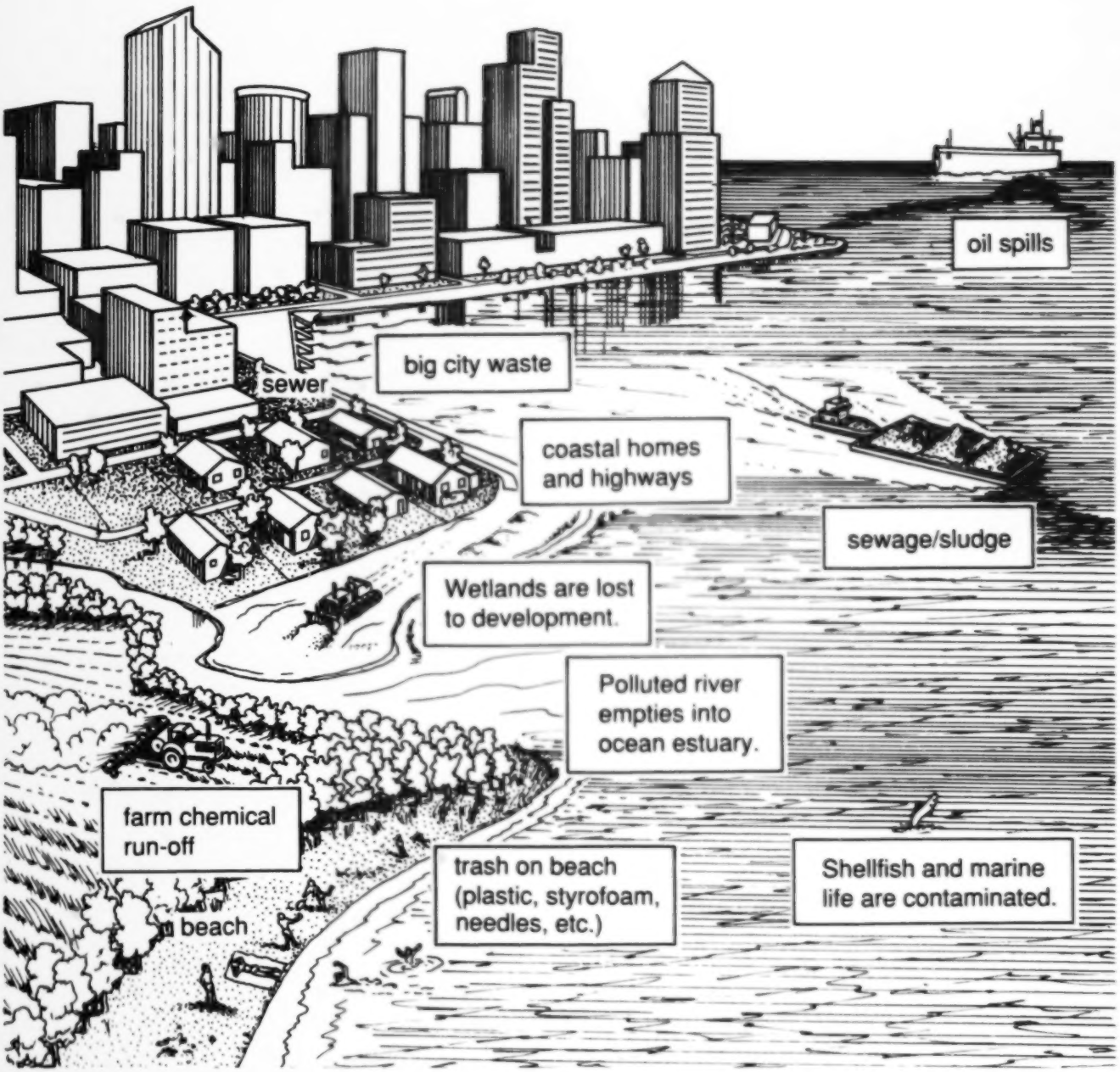
Ocean and Coastal Water Pollution



Q

1. What causes pollution of the coastal waters and oceans?

2. Why didn't we have these water pollution problems when our country was young?

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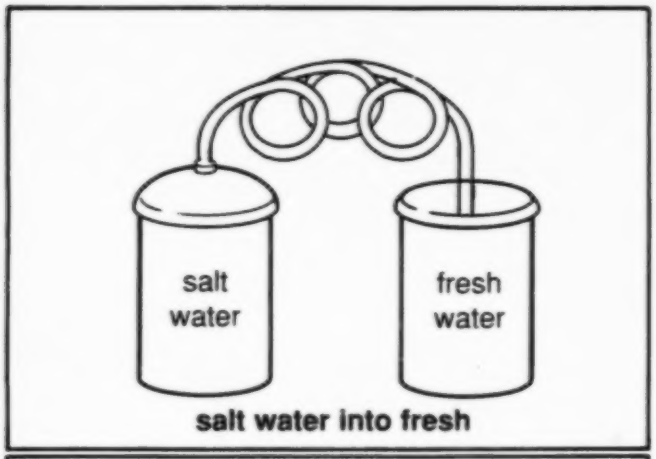
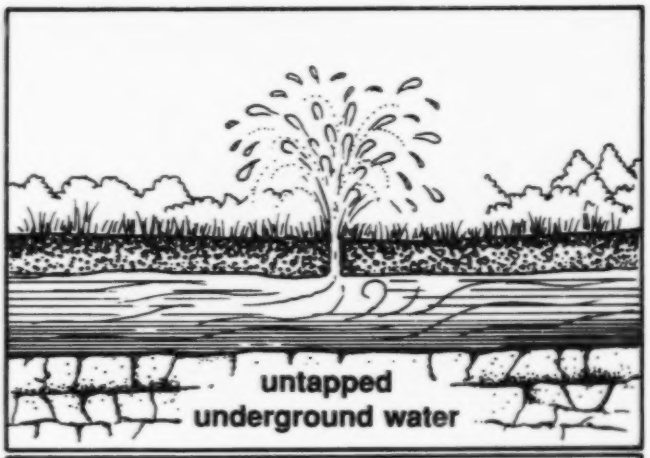
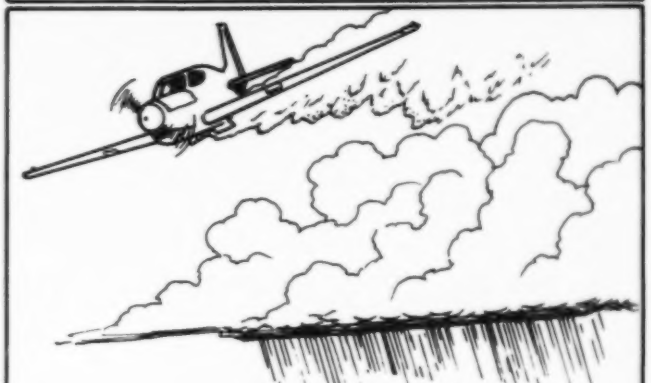
Clean Water for a Thirsty World

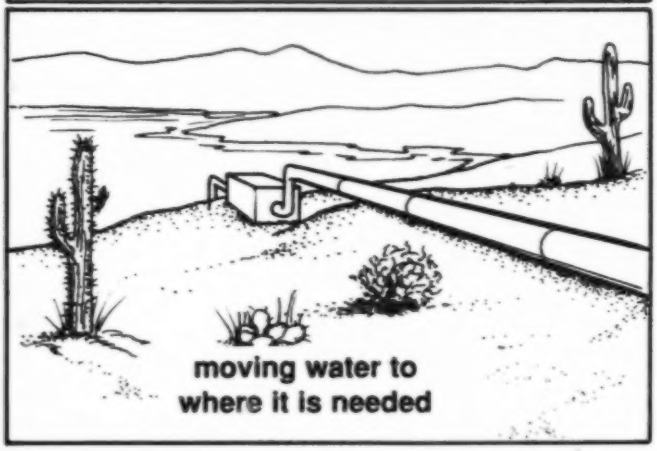


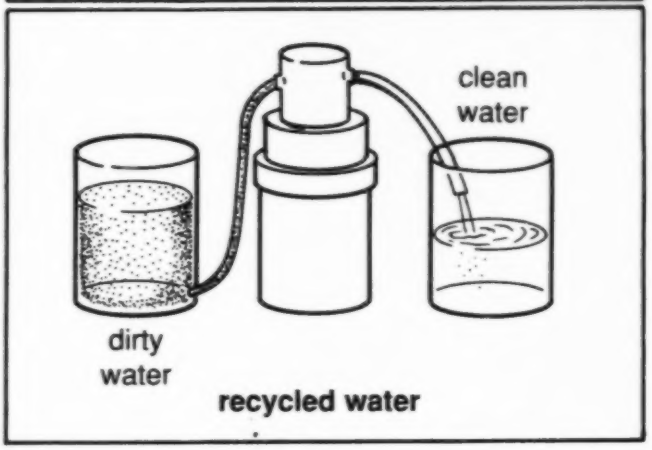
salt water into fresh


untapped underground water

water from icebergs and glaciers


making rain


moving water to where it is needed



recycled water

1. Which of the above seems most possible? Why do you think so?

2. What can you do every day to save water?

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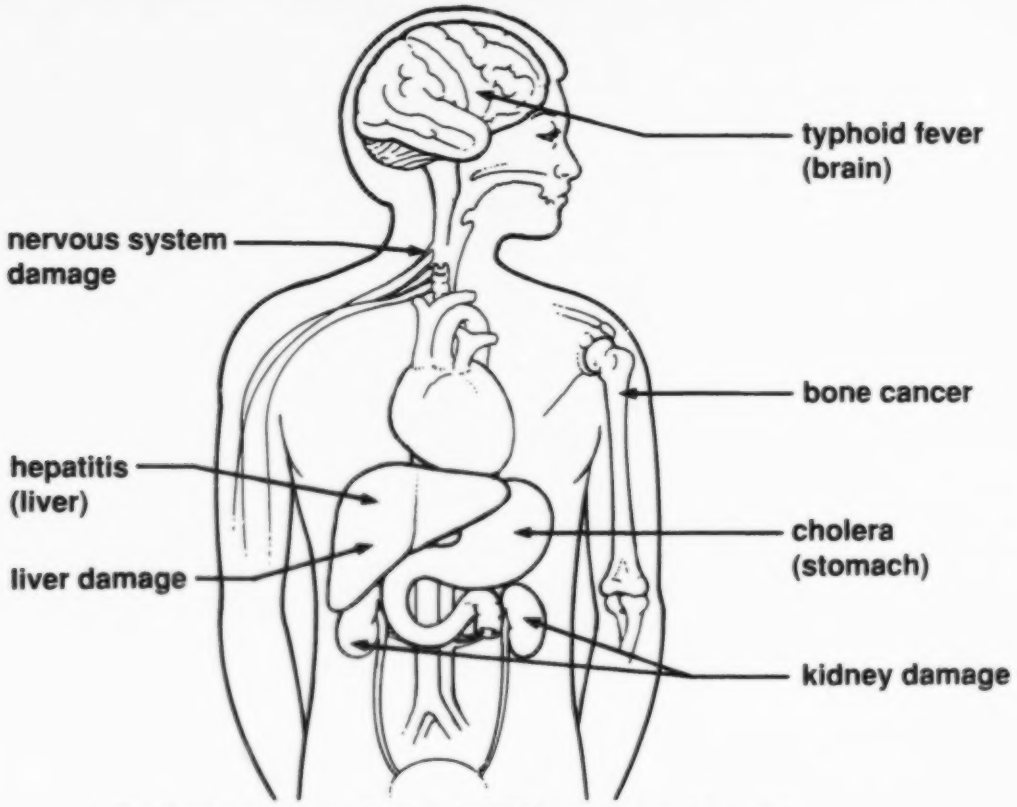
Water Pollution and Your Health



Pollutants and Their Effects on Health

Bacteria (from human waste)	***Chemicals*** (from factories and agriculture)	***Radioactive Compounds*** (found in some soils and wastes created by humans)
• typhoid fever • cholera • hepatitis	• nervous system damage • liver damage • kidney damage	• bone cancer • other cancers

Q

1. What are three kinds of pollutants that can enter water systems?

2. What pollutants do factories and agriculture release?

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Helping to Keep Our Water Clean

Government

Clean Water Act of 1972

- Passed laws stating that all surface water would be fishable and swimmable by 1983
- Limited the amount of factory discharge into surface waters

Safe Drinking Water Act of 1974

- Set water standards for all public water systems
- Gave government power to control 26 pollutants in public water systems

Communities

Shower less than five minutes.

Don't fill bathtub to the top.

Wash full loads in washing machine. Use cold water.

Don't pour furniture polish or auto products down the drain.

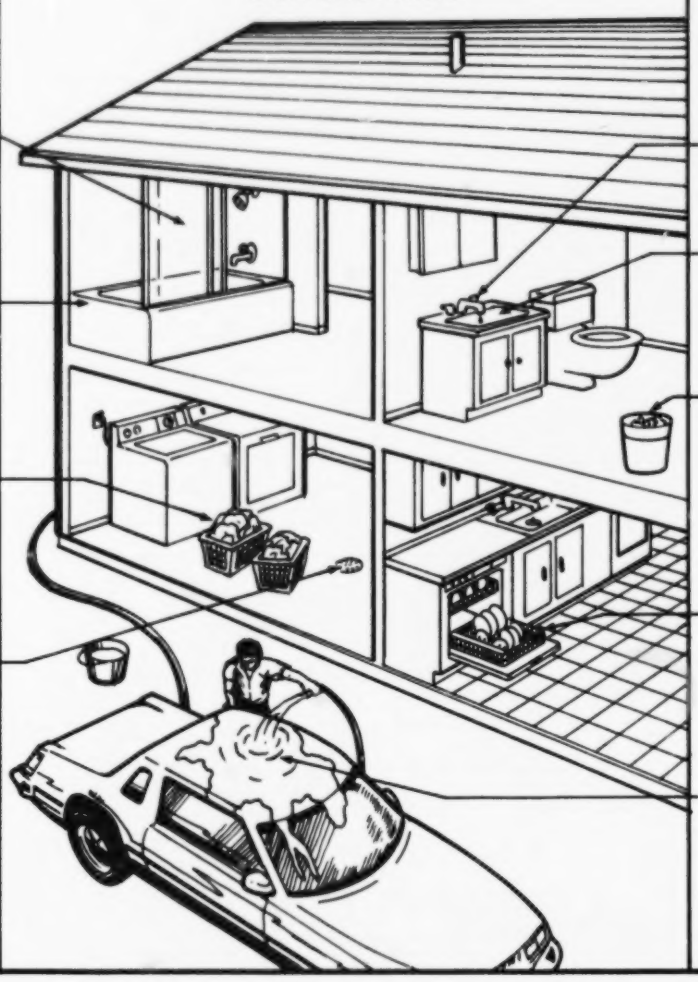
Repair leaky faucets.

Don't let water run while brushing teeth.

Use waste container for tissues, hair, etc. instead of toilet.

Wash full loads in dishwasher.

Wash car in sections and rinse with short spurts of water.



Q

1. What are two household products that should not be poured down the drain?

2. What are three ways to conserve water in the bathroom?

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Make Your Own Water Cycle

Materials: hotplate, teakettle of water, two metal pots with safety handles, ice cubes, potholders

Procedure: (CAUTION—THIS ACTIVITY SHOULD BE CLOSELY SUPERVISED.) Place the teakettle of water on the hotplate. When the water boils and steam comes from the spout, have someone hold a pot of ice cubes over the steam. Have another person hold the other pot under the pot of ice cubes.

Evaporation **Condensation** **Precipitation**

Results:

1. What represents the sun in this activity? _____
2. What represents the clouds in this activity? _____
3. What represents the rain in this activity? _____

Conclusion: Explain the water cycle in the activity. Draw a line from the words at the bottom of the picture to the correct part of the picture.

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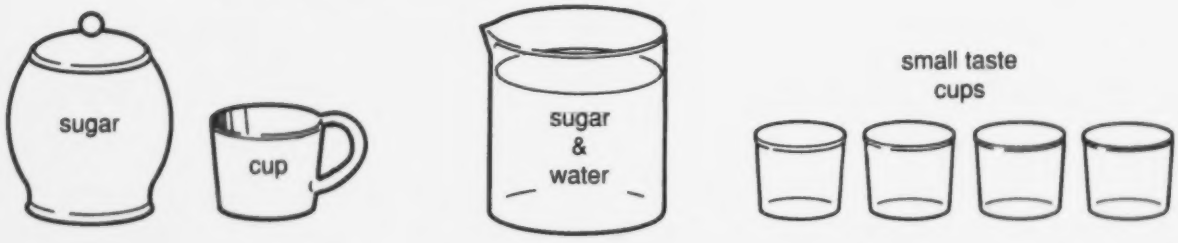
Water Pollution

Question: Is it safe to dump toxic chemicals into waterways?

Materials: sugar, water, clear container, measuring cup, small cups

Procedure:
1. Mix 1/4 cup sugar (representing toxic chemicals) with 1 cup water. Record what students see.
2. Pour a very small amount of sugar water into a tiny cup for each student to taste. Record taste.



Repeat steps 1 and 2, adding 1 cup of water each time. Complete the chart below with observations.

Results:

sugar	water	what I see	what I taste	comments
1/4 c	1 c			
1/4 c	2 c			
1/4 c	3 c			
1/4 c	4 c			

1. Could you ever see the sugar (toxic chemicals)? _____

2. What happened to the taste as you added water? _____

_____

Conclusions:

1. Because you don't see the sugar (toxic chemicals) and its taste gets less sweet, does that mean the sugar is gone? _____

2. Will it be safe to drink from waterways with toxic chemicals when you cannot see or taste them?

_____

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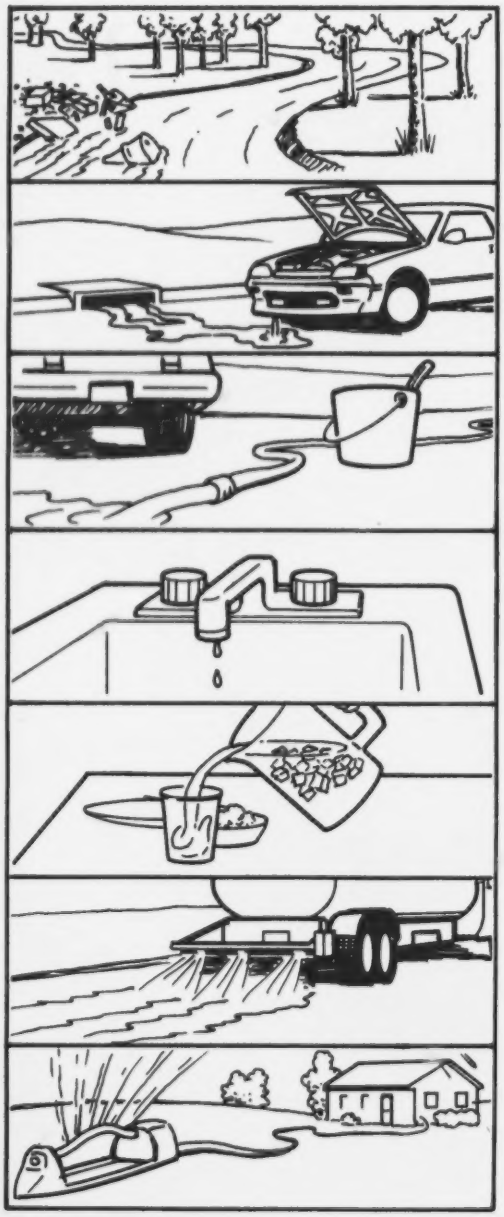
What Are Some Ways That People Waste Water?

We can protect our water resources by safely disposing of hazardous waste products and by conserving water. Take a walk in your neighborhood and observe the people and businesses in your community. Look at restaurants, gas stations, shops, and waterways. Watch for these wasteful or unsafe water practices. Answer each question yes or no.



Have you seen:

1. litter thrown into creeks or lakes? _____
2. hazardous waste, such as auto products, thrown into sewers? _____
3. people leaving the hose on as they wash their cars rather than rinsing with short spurts of water? _____
4. leaky faucets in public restrooms? _____
5. restaurants automatically refill water glasses instead of serving water on request only? _____
6. parking lots cleaned with water hoses instead of with brooms or vacuums? _____
7. gardens and lawns watered during hot afternoons when water evaporates the quickest? _____
8. List other wasteful or unsafe water practices you may have observed. _____

_____

_____

_____

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Review Quiz

A. Circle the correct answer.

1. Heated water can be a source of water pollution. T F
2. About 50% of the earth's surface is covered with water. T F
3. The process of liquid water changing into a gas is known as evaporation. T F
4. Oil spills only happen in the ocean. T F
5. One source of water for the future may come from icebergs. T F

B. Match the letters in column B with the phrases in column A.

A	B
_____ 1. used in making water pure	a. cholera
_____ 2. source of ground water	b. chlorine
_____ 3. disease caused by polluted water	c. precipitation
_____ 4. fixing leaky faucets	d. secondary treatment
_____ 5. removing sludge	e. water conservation

C. Circle the correct answer.

1. One source of water pollution is _____.

ground water rain water crop pesticides

2. Solid materials removed from waste water are known as _____.

sludge fluoride filter

3. The _____ is the upper surface of ground water.

run-off settling basin water table

4. The amount of usable fresh water on the earth is about _____ percent.

one two three

5. _____ is one effect of acid rain.

Oil spill Dead fish Typhoid fever

D. Answer on back of paper.

What are some results of ocean and coastal water pollution?

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Teaching Guide

Background Information for Visuals:
The Water Cycle

The liquid water on the earth moves through an endless cycle called the water cycle, or the **hydrologic cycle.** The first part of the cycle, evaporation, is the movement of surface water from streams, lakes, and oceans into the air. Liquid water, when heated, gains sufficient energy to change into water vapor (a gas). In addition to this water vapor from bodies of water, animals give off water vapor when they perspire as do plants when they transpire. This water vapor then rises into the atmosphere. When water vapor molecules lose energy, they condense. Condensation, the second part of the water cycle, occurs when water vapor changes back into a liquid. Water vapor in the atmosphere (from evaporation) changes into water droplets (condensation) and forms clouds. Precipitation, the third part of the water cycle, falls to the earth's surface in the form of rain, snow, sleet, or hail. The precipitation that reaches the earth may run off the surface into streams or larger bodies of water. It may also soak into the ground and become ground water. Natural springs bring some ground water to the surface. Also, people drill wells to bring ground water to the earth's surface.

For Discussion: *What are the three major steps in the water cycle?* The three major steps in the water cycle are evaporation, when liquid water changes to steam and rises into the atmosphere; condensation, when water vapor in the atmosphere changes to water; and precipitation, when water droplets in the atmosphere fall to earth. *Why does the water in the polar ice caps usually not become part of the water cycle?* The water in the polar ice caps is frozen and does not evaporate.

Sources of Water Pollution

The picture depicts a number of sources of water pollution. Acid rain, resulting from moisture in the atmosphere mixing with airborne chemicals, causes lakes to become acidic. Our activities at home, such as improperly disposing of household chemicals and used motor oil, contribute to water pollution. Some campers simply throw dishwater and other wastes into lakes and streams. Pesticides and fertilizers sprayed on fields run off into lakes and rivers. Improperly cultivated fields can cause soil to erode and wash into streams. Wastes from farm animals also pollute our ground water supply. Industrial activities are yet another source of water pollution. Chemical wastes, heated water, and oil spills are all pollutants that adversely affect the quality of water and aquatic life. Whole communities contribute to water pollution when liquid from landfills runs into water supplies and when wastes from sewage treatment plants are dumped into the waterways.

For Discussion: *How could the water pollution shown be corrected?* Possible answers: Individuals should read labels to learn how to properly dispose of waste products. They can use cleaning products that do not contain toxic chemicals or artificial dyes and scents. They should dispose of tissues and other paper products in the trash, not in the toilet. Farmers, citizens, or local governments can plant crops or some ground cover (e.g., grass) to prevent soil erosion. Private companies and corporations can stop dumping waste and can seek alternative methods of waste disposal.

Governments should pass laws correcting the sources of acid rain—laws that force industries to clean up their own pollution and stop dumping waste products such as chemicals and heated water into waterways. Governments can pass laws banning all use of pesticides and fertilizers that are harmful if washed into waterways and laws ensuring that all sewage is properly treated in treatment plants. They should also mark hazardous water areas or remove the hazards to prevent oil spills.

Waste Water Treatment

Waste water is the used water that flows from a community. It comes from many sources: commercial (businesses), industrial (factories, plants), residential (homes), storm water, and ground water. Most communities have one system of sanitary sewers that carry only domestic and industrial waste water and another sewer system that carries storm water run-off. Sewers are underground pipes that carry water and waste products from a building.

The waste water from the sewer system either flows from the force of gravity or is pumped into the treatment plant. In primary treatment, solids are physically removed from the water by screens, settling tanks, and skimming devices. In secondary treatment, contaminants in the waste water are biologically removed. Air is supplied to encourage the growth of bacteria that consume the waste materials. The solids, called sludge, that were removed from the water, are further treated so that sludge can be disposed of in landfills, incinerated, or used as a soil conditioner.

Before treated water is released into a receiving body of water, small amounts of chemicals are added to disinfect the water.

For Discussion: *Where is waste water created in our homes?* Waste water comes from sinks, toilets, dishwashers, bathtubs, shower stalls, and washing machines.

Making Water Pure

Our drinking water comes from two sources of untreated water: surface water, such as rivers and streams, and ground water, which comes from underground reservoirs trapped by permeable layers of sand, gravel, or porous rock. Before this water can be used for drinking, it must be treated. At a water purification plant, huge electrical intake pumps deliver the untreated water to a sedimentation basin, which looks like a large swimming pool. Large scrapers at the bottom of the basin push matter that has settled to the bottom to drainage pipes that discharge the waste. The sediments may be washed away or hauled away. The water is not clean; it still has some suspended material. Chemicals that attract the remaining sediments are added to the water in the mixing basins. This process is known as **coagulation.** The chemicals attach to the particles and cause them to settle. The coagulation process may be repeated several times during the cleaning process. The water then travels through filter basins where the last traces of sediments are strained out and left behind in layers of gravel, sand, and carbon. Chlorine, added several times during the cleaning process, destroys bacteria. Small quantities of fluoride may also be added as a deterrent to tooth decay. The clean water is then distributed to homes and industries through a vast network of underground water pipes.

For Discussion: *How is sediment removed from the water at the treatment plant?* Larger sediments are allowed to settle in sedimentation basins; the cleaner water is then moved to mixing basins where chemicals are added to remove the finer sediments, and finally the water is filtered to remove all remaining sediment.

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Page 1 Water on the Earth

Objective: Compare the total amount of water on the earth to the percentage we can actually use.
Background Information: About 97% of the water on earth is salt water found in the oceans, seas, and in some inland seas and lakes. Salt water is not usable for drinking, irrigation, or industry. However, it does supply most of the precipitation that falls to earth. When salt water evaporates, the salts remain behind. (Refer to the water cycle picture.) About 2% of the water on earth is nonusable fresh water. This is frozen in glaciers and ice caps. Only about 1% of the water on earth is usable fresh water. Since it is not distributed evenly over the earth, however, distribution to various areas is a problem. Another problem is that fresh water can become polluted.
Directions: Stress the significance of the very small proportion of water on earth that we can use. Use the following demonstration to introduce the topic.

Fill a one-cup measuring cup with water. Label it *water on earth.* Then remove 1 teaspoon of water (approximately 2%) and place this water in a small container. Label it *nonusable fresh water.* Next remove ½ teaspoon of water (approximately 1%) and place in another small container. Label it *usable fresh water.* Pour all the remaining water from the one-cup measuring cup (approximately 97%) into a glass. Add a quantity of salt to the water. Label it *salt water.*

Use the background information with the class in a discussion of the earth's water as students complete the worksheet.
Answers: 1. water 2. salt water 3. 1%
Extension Activities: 1. Research the major bodies of water and the locations of major cities in your area. Label them on a map. 2. Correlate with social studies by finding out why one of the cities in your area was founded where it was and how water was important to the city's founding (industry, trade, travel, or recreation). What water problems does that city face?

Page 2 Ground Water and the Watershed

Objective: Identify the sources of ground water and ground water pollution.
Background Information: Ground water is stored beneath the earth's surface between layers of rock, sand, and soil. Precipitation soaks into the ground and fills the pores of these rock formations. Formations that produce usable amounts of water for consumption are called **aquifers.** The top of the unconfined aquifer is called the water table.

Ground water supplies are replenished when precipitation filters through the soil and reaches the aquifer. Unlike ground water, surface water is precipitation that runs off the earth's surface into streams, rivers, and lakes. The area through which surface water moves and drains into a stream is known as the **watershed.**

Ground water provides 96% of the world's total freshwater supply. Half of the U.S. population depends upon ground water for daily consumption. However, both natural conditions and human activities threaten to contaminate ground water supplies. Natural problems include minerals that dissolve into the water and radionuclides that are released from within the earth. Human-related contaminants include those from septic tanks, treatment lagoons, landfills, fertilizers, pesticides, mines, and abandoned hazardous waste sites.

Directions: Use the background information provided to show ground water replenishment and sources of ground water pollution.
Answers: 1. Ground water supplies are replenished when water from precipitation filters through the soil and reaches the water table. 2. Sources of ground water pollution shown are the septic tank, pesticides, factory discharge, and sewer leakage.
Extension Activities: 1. Research the different types of rock formations which produce "confined" and "unconfined" aquifers. 2. Correlate with library skills to find where these U.S. cities receive their water supply: Los Angeles, Houston, Chicago, St. Louis, New York, Denver, and Miami; and where these foreign cities receive theirs: Sydney, Australia; Cairo, Egypt; Mexico City, Mexico; and Moscow, U.S.S.R.

Page 3 Acid Rain

Objective: Create an awareness of causes of acid rain and the damage acid rain does to the environment.
Background Information: Acid rain is precipitation that has a high concentration of acid. It forms when rain, snow, sleet, or fog combines with nitrogen oxide or sulfur dioxide in the presence of sunlight. Nitrogen and sulfur oxides are gases given off by the burning of fossil fuels (coal, gas, oil) in automobiles, factories, and power plants. Winds may carry these gases for hundreds of miles into the atmosphere where they dissolve in moisture. Droplets of acid fall to the earth in the form of precipitation.

Scientists use a number called pH to measure a substance's acidity. A pH lower than 7.0 means the solution is acidic. The closer to 0.0 the pH is, the more acid the solution contains. Normal rainwater is slightly acidic. It has a pH of about 5.6. However, acid precipitation can have a pH between 2.0 and 5.5.

This acid precipitation enters the ground and chemically reacts to release the aluminum that exists in rock and soil. The aluminum then drains into lakes, rivers, and oceans where it kills aquatic life. Acid precipitation also reduces soil fertility and makes soil unable to sustain life. Whole forests, such as Germany's Black Forest, are being destroyed.
Directions: Use the background information to develop an understanding of the causes of acid rain and how it can damage the environment.
Answers: 1. Acid rain kills fish and plants and damages buildings and other structures. 2. Laws must be passed and enforced to reduce amounts of sulfur dioxide and nitrogen oxide emitted by burning fossil fuels. (example: Companies can be forced to put scrubbers on smokestacks and to wash coal.) People should car-pool and government and/or companies should develop more mass transit.
Extension Activities: 1. Research and locate various places in the world that are affected by acid rain. Determine the origin of the acid gases in these places. 2. Correlate with social studies by having part of the class represent the U.S. and part Canada in a discussion of Canada's fishless lakes and dying forests, situations caused by acid rain from emissions at factories in Ohio and Pennsylvania. Ask students how this conflict can be resolved. Have them suggest possible consequences if it cannot be resolved.

Page 4 Oil Spills

Objective: Recognize the serious damage oil spills cause to the environment.

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Background Information: One of the most visible and damaging water pollutants is spilled oil. Even communities that are long distances from oil spills are affected. Oil spills cause a loss of plant and animal food sources. The oil is toxic to many forms of aquatic life. The use of recreational areas is severely restricted by oil spills. Boating and swimming areas cannot be used; fishing grounds are ruined. The oil lost in a spill reduces the amount of oil available and may cause higher fuel prices. Some researchers estimate that it may take more than ten years for a damaged area to return to conditions somewhat near pre-spill conditions.

Directions: Use current newspaper and magazine articles to introduce the discussion of oil spills. Talk about what has happened in the picture and the consequences of the accident. Conclude the discussion by offering suggestions of how the oil spill could be cleaned up and ideas for the prevention of such accidents in the future. At the end of the lesson, have the student complete the two activities at the bottom of the worksheet.

Answers: 1. Possible answers include oil washing ashore and ruining beaches; plants and animals dying; rocks and other land features being covered with black oil; fishing and other activities not being possible. 2. stricter enforcement and monitoring of safety precautions, inspection of storage facilities and pipelines, and so on

Extension Activities: 1. Research where the oil producing areas of the world are located. Where are the greatest oil consumer countries? Record findings on a map and graph. Why is it necessary to transport oil by water? 2. Correlate with language arts by having the students draw a method or machine that could clean up future oil spills; have them explain how it works in a written or oral report. The invention might be realistic or fanciful.

Page 5 Ocean and Coastal Water Pollution

Objective: Recognize the causes and dangers of pollution to our waterways.

Background Information: Coastal waters and wetlands are being increasingly polluted. The expansion of residential areas, shopping centers, and roads into wetlands has made these lands and the adjoining coastal waters more susceptible to pollution. Liquids from chemical wastes, pesticides, fertilizers, sewage, and trash are finding their ways into the ground and surface waters of the land. Eventually the pollution flows into the coastal waters. The result is the contamination and killing of marine life in estuaries, harbors, and oceans. Toxic substances are absorbed by tiny sea organisms and enter the food chain with disastrous results to the fish, bird, and mammal populations. In some areas, clams and oysters become unfit to be eaten. In order to prevent further pollution, stricter laws are needed to regulate the treatment of sewage, the release of industrial wastes, oil transportation, and the disposal of garbage and wastes.

Directions: Use the worksheet to review the many possible sites of pollution as well as sources and consequences of pollution.

Answers: 1. Some causes of water pollution are sewage sludge, trash, pesticides, fertilizers, chemicals, and oil spills. 2. There were not as many people and industries.

Extension Activities: 1. Research the cost in damage to fish, wildlife, and spoiled beaches in Prince Edward Sound, Alaska, by the wreck of the oil tanker Valdez in March of 1989. 2. Correlate with social studies by having students locate Alaska on a map. Analyze why Alaska still has plentiful fish-breeding grounds.

Page 6 Clean Water for a Thirsty World

Objective: Encourage students to see future possibilities for fresh water and to practice problem solving.

Background Information: There is great demand for the one percent of the world's fresh water. The available water is not equally distributed over the surface of our planet. Many places in the world are faced with serious problems regarding water resources. This is, however, not an entirely new problem. The Egyptians built a freshwater canal in 2500 B.C. for the purposes of irrigating and supplying drinking water in an area without adequate fresh water. Many new ideas are being proposed and tested to help make more fresh water readily available. "Seeding" clouds with chemicals has been used successfully to cause rainfall in drought-stricken areas. Nearly 80% of the earth's fresh water is contained in the polar ice caps. Scientists have proposed hauling huge icebergs to arid lands. Various methods are being tested to develop more efficient irrigation techniques and to reduce evaporation from reservoirs.

Directions: Use the worksheet for directed student study of the possible sources of drinking water on the earth.

Answers: 1. Accept any of the answers. An example: untapped underground water because we already drill for water wells. 2. Turn off water faucets tightly; fix leaky faucets; shower instead of bathing; run only full dishwasher and washing machine loads; turn off water while brushing teeth, rinsing contacts, and so on.

Extension Activities: 1. Research through magazines and newspapers about how California, a big agricultural state, has brought water to semi-arid lands. 2. Correlate with social studies by having students read the history of the remarkable Roman aqueducts.

Page 7 Water Pollution and Your Health

Objective: Identify the effects of contaminated water supplies on human health.

Background Information: Throughout history, human organic waste has provided the greatest threat to the safety of public water sources. Cholera, a gastrointestinal disease, was brought under control by the early 1870s in the U.S., but typhoid, a disease causing fever, diarrhea, and intestinal inflammation, was not controlled until 1910. These diseases were contained when water systems adopted chlorination and filtration. The chlorine and filtration procedures killed disease-causing bacteria. When toxic chemicals are used or discarded improperly by U.S. industry and agriculture, they can pollute ground and surface waters. There are 20 chemicals monitored by the EPA in public water supplies that have been found to damage the nervous system, circulatory system, kidneys, and liver. These include barium, lead, mercury, and nitrates.

Radioactive compounds are sometimes in drinking water drawn from groundwater wells. In some regions, uranium and radon deposits occur naturally in the soil and can contaminate the wells. In a few cases, radioactive waste generated by people has been the source of contamination. Radioactive compounds cause cancer when ingested.

Directions: Use the background information provided to show the relationship between water pollutants and their health effects.

Answers: 1. Three kinds of pollutants that enter water systems are bacteria from human organic waste, chemicals from industry and agriculture, and radioactive compounds. 2. Factories and agricul-

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ture release chemicals which enter both ground water and surface water systems.

Extension Activities: 1. Research the 1849 cholera outbreak in London. Find out what important discovery Dr. John Snow made. 2. Correlate with social studies by locating on a world map or globe these nations which still have outbreaks of typhoid and cholera due at least in part to ineffective water processing: Brazil, Bolivia, Colombia, India, Pakistan, Thailand, Kenya, and Tanzania.

Page 8 Helping to Keep Our Water Clean

Objective: Describe measures the government has taken to control water pollution. Describe activities in which communities participate to reduce pollution.

Background Information: Although waste water treatment has been practiced for over 100 years in the U.S., only since the 1970s have strict standards for clean water been mandated by federal law. The Clean Water Act of 1972 set water quality standards for bodies of surface water and limited the amount of industrial waste discharged into them. Drinking water regulations issued by the 1974 Safe Drinking Water Act set water standards for all community water systems and require monitoring of pollutants that may have an adverse effect upon human health. The Comprehensive Environmental Response, Compensation and Liability Act, also known as Superfund, is used to clean existing hazardous waste sites which threaten water resources.

Communities can contribute to maintaining clean water supplies by practicing conservation and safely disposing household hazardous waste. Gasoline, pesticides, and furniture polish are several of the household substances that should not be poured down the drain or out on the ground. They should be disposed of during community-wide collection programs or placed in the trash after they are properly sealed and identified.

Directions: Use the background information provided to show students measures that the government has taken to control water pollution and steps that students themselves can take in their own communities to help.

Answers: 1. Household cleaners, such as furniture and floor polish, and auto products such as oil, brake fluid, and gasoline should not be poured down the drain. 2. Ways to conserve water in the bathroom are using a waste container instead of the toilet for trash, only running the water when needed while brushing teeth, showering less than five minutes, not filling the bathtub to the top, and repairing leaky faucets.

Extension Activities: 1. Research the varying amounts of water that different household appliances use. 2. Correlate with written language and write a letter to local waste water treatment officials for more information on disposing of hazardous household waste.

Page 9 Make Your Own Water Cycle

Directions: Before the activity review the water cycle chart. After the activity have the students complete the results and conclusion portion of the worksheet.

Results: 1. hot plate 2. steam 3. drops of water falling from underneath the pot of ice cubes

Conclusion: Evaporation is the steam rising from the teakettle. Condensation is the water droplets forming on the pot of ice cubes. Precipitation is the water from underneath the pot of ice cubes falling into the bottom pot.

Compare what is happening in the activity to what happens on the color illustration or outside in nature. *Where else in the classroom could you observe an indoor water cycle?* window pane, glass of ice water, terrarium. *How does pollution harm the water cycle?* During precipitation, unpolluted atmospheric moisture falls to earth. However, as the precipitation falls through polluted air, it becomes polluted. Or if the precipitation falls on polluted water or soil, it also becomes polluted. *How does the water cycle help pollution?* When water evaporates, impurities (pollutants) are left behind.

Page 10 Water Pollution

Answer: No; toxic chemicals pollute waterways.

Directions: *Caution:* Check that no student is diabetic. Each student has own cup.

Results: The following chart shows results from the experiment.

sugar	water	see	taste	comments
1/4 c	1 c	cloudy water	very sweet	tastes sweet; looks cloudy but can't see sugar
1/4 c	2 c	clear water	sweet	tastes; can't see sugar
1/4 c	3 c	clear water	little sweet	tastes less sweet; can't see sugar
1/4 c	4 c	clear water	barely sweet	tastes less sweet each time; can't see sugar

1. No—could not see sugar (toxic chemicals). 2. Taste grew less and less sweet until almost tasteless.

Conclusions: 1. No, the sugar (toxic chemical) is spread out but is still there. 2. No, the toxic chemicals dumped into the waterways have spread out and, even though they are not visible, the toxic chemicals are still in the water.

Page 11 What Are Some Ways That People Waste Water?

Objective: Identify neighborhood water pollution sources.

Directions: Students make observations in their community and then record answers on take-home worksheets. Teacher tallies on the board or on a chart the number of yes/no answers from the worksheet. Discuss the ways water was polluted or wasted in the community.

What was the major source of pollution?
What wasteful water practice was observed most often?
What can be done to stop these wasteful or unsafe practices?

Page 12 Review Quiz

A. 1. T 2. F 3. T 4. F 5. T
B. 1. b 2. c 3. a 4. e 5. d
C. 1. crop pesticides 2. sludge 3. water table 4. one 5. Dead fish
D. Possible answers include those answers found in "Ocean and Coastal Water Pollution," on page 5.

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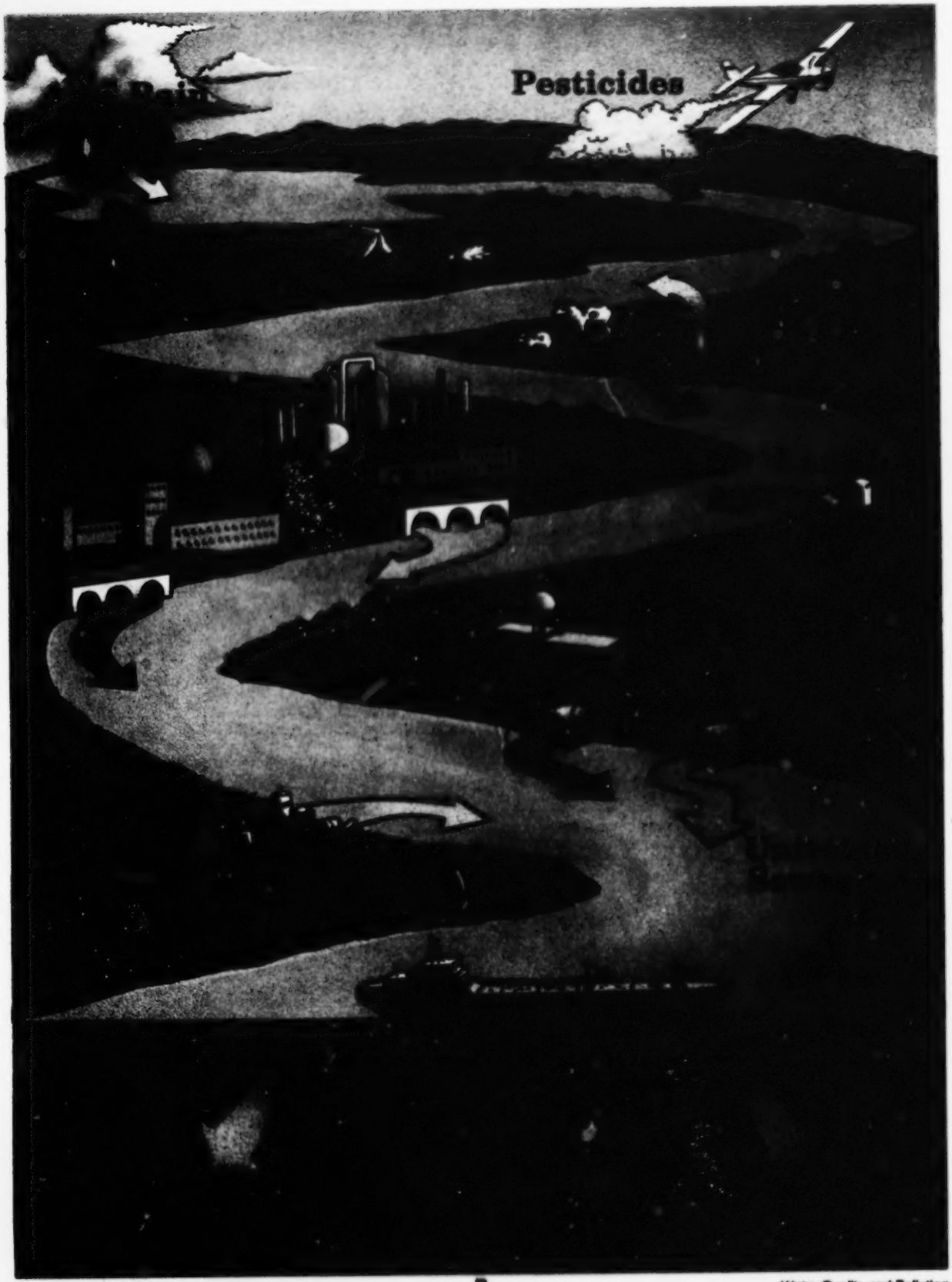
Water Quality and Pollution



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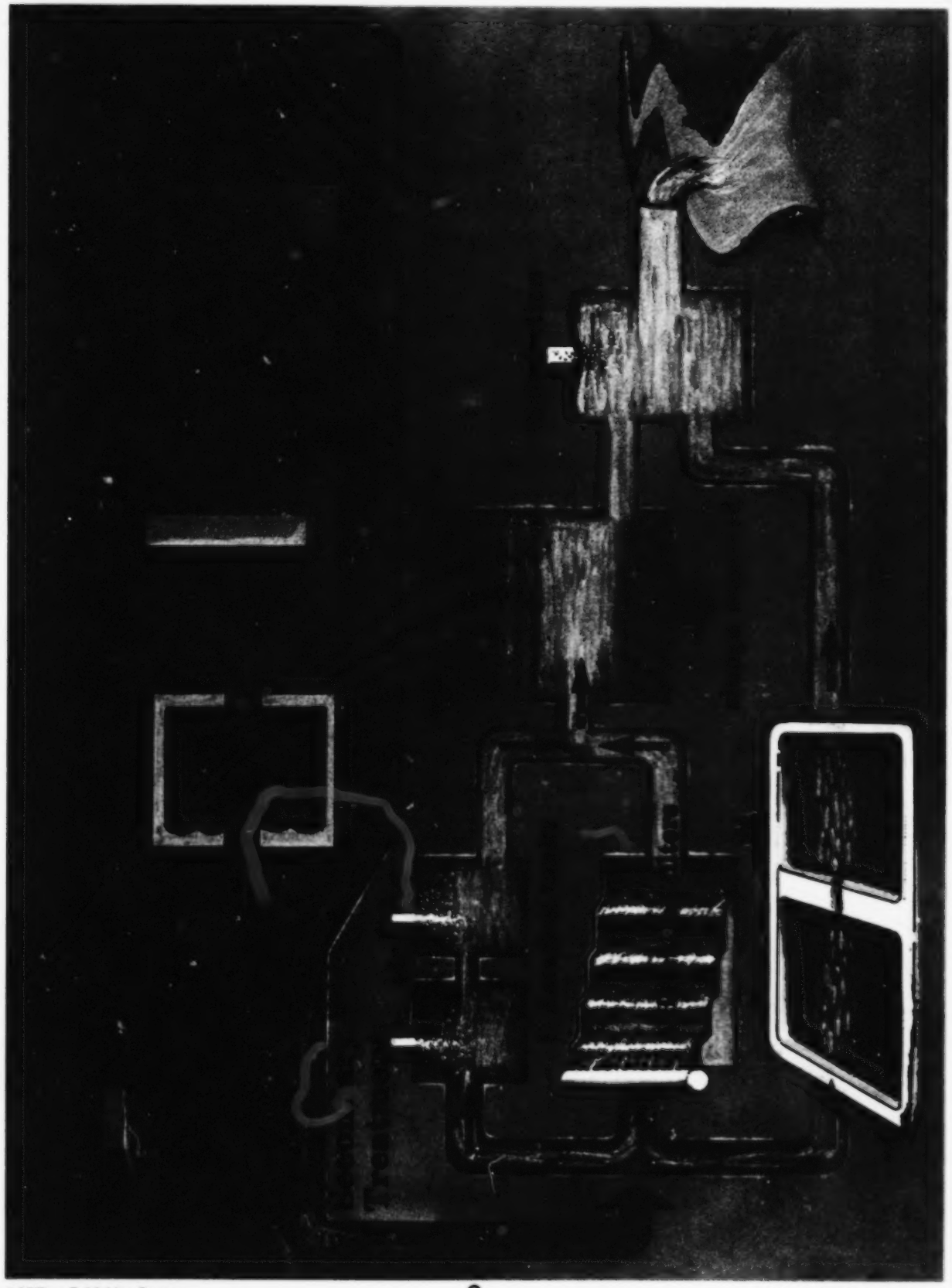

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